Comparing Main Injector Flying Wire proton emittances at 8 and 150 GeV in recent stores (after store 6792) with stores before multibatch operation started.

Looking at horizontal emittances since the vertical MI wire is broken. We started having lower than expected initial luminosities from store 6737 and on.

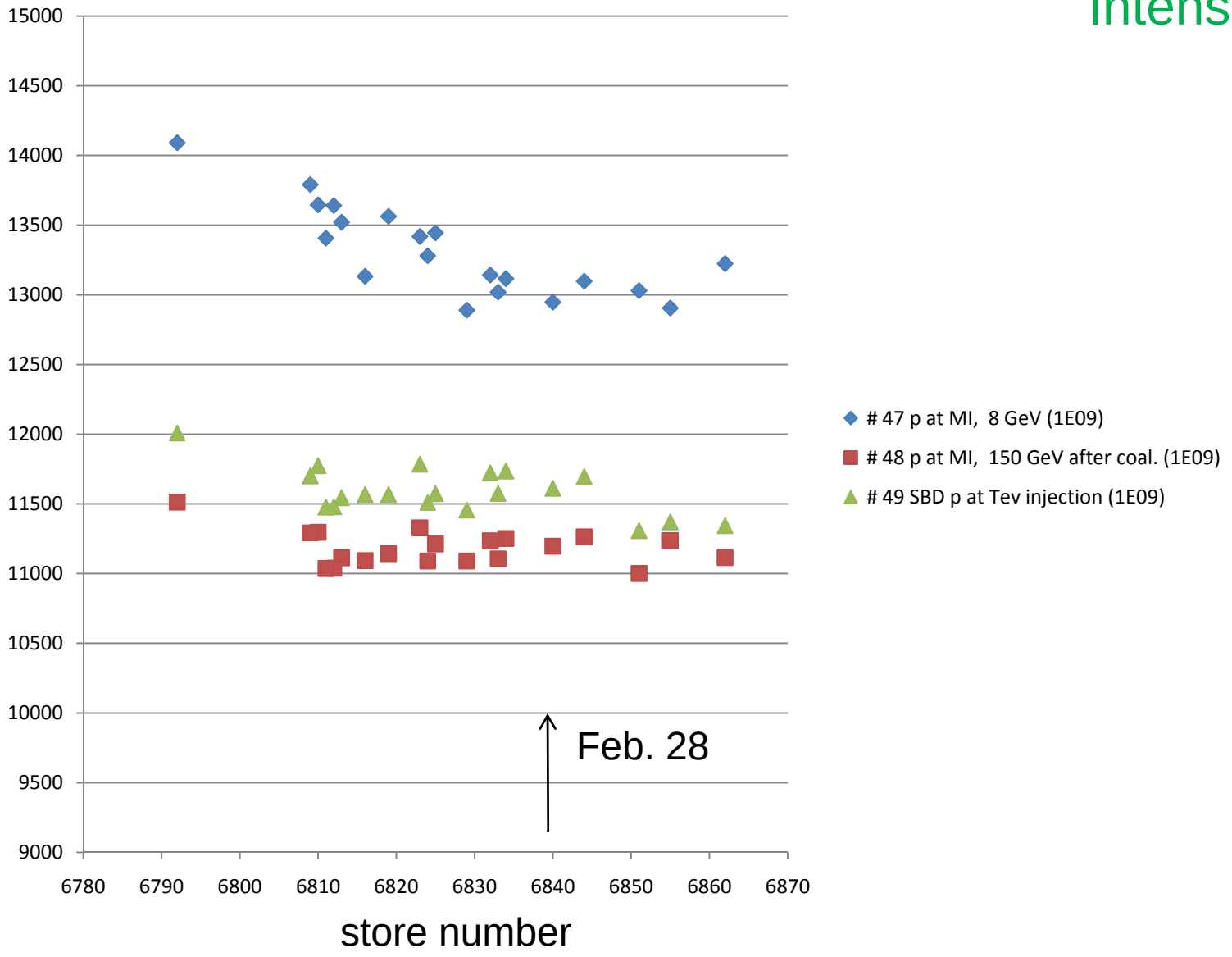
Vaia Papadimitriou

March 4, 2009

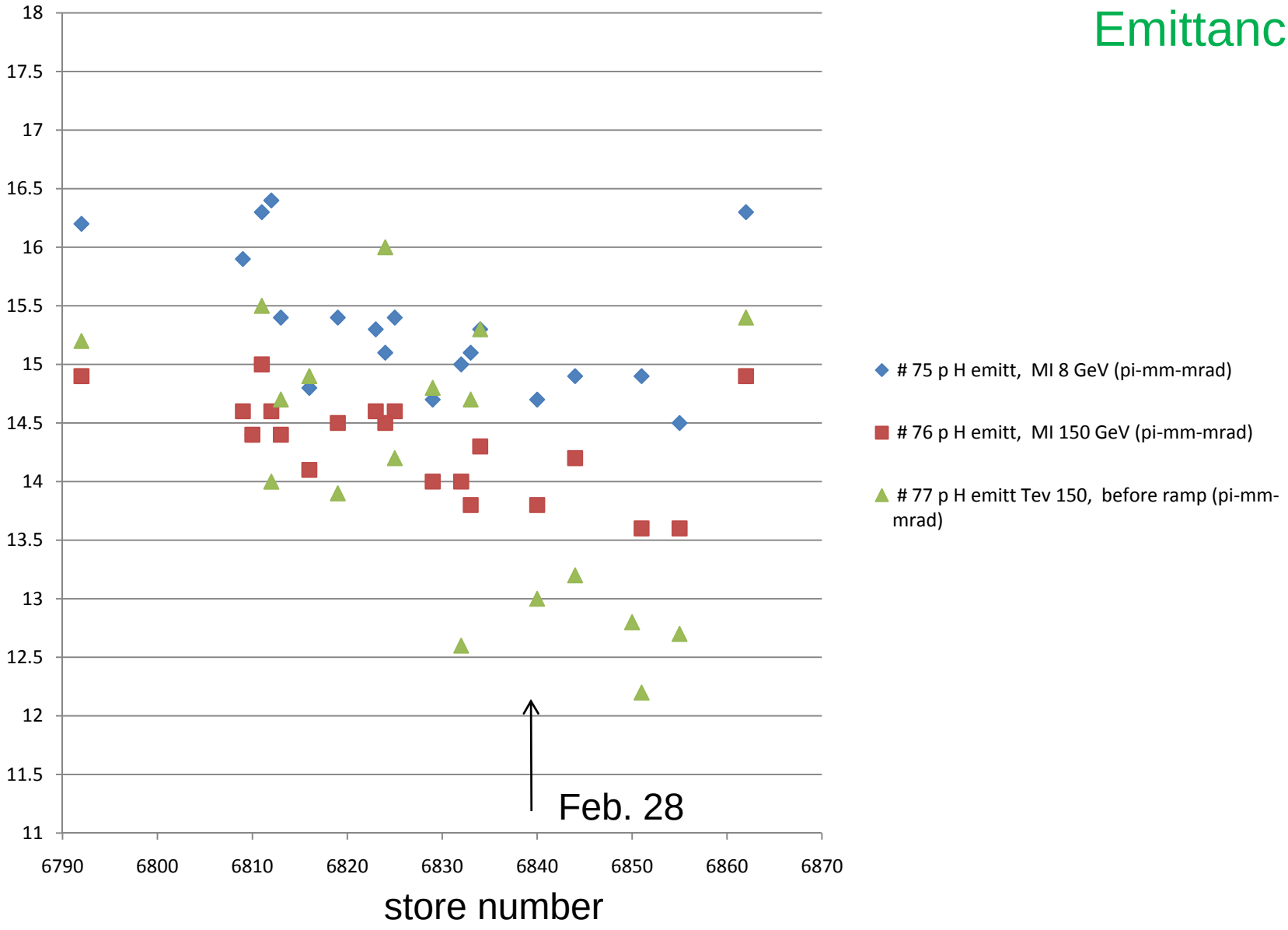
Trying to find out if the proton transverse emittances from the Booster and Main Injector at 8/150 GeV look different after store 6737 than before. Are they smaller, bigger, do they have more tails, etc. Since we are scraping at 8 GeV at MI, is it possible that the scraping now has different effects than before because the emittances look different?

Stores 6792-6862 (Feb. 10-Mar. 4, 2009)

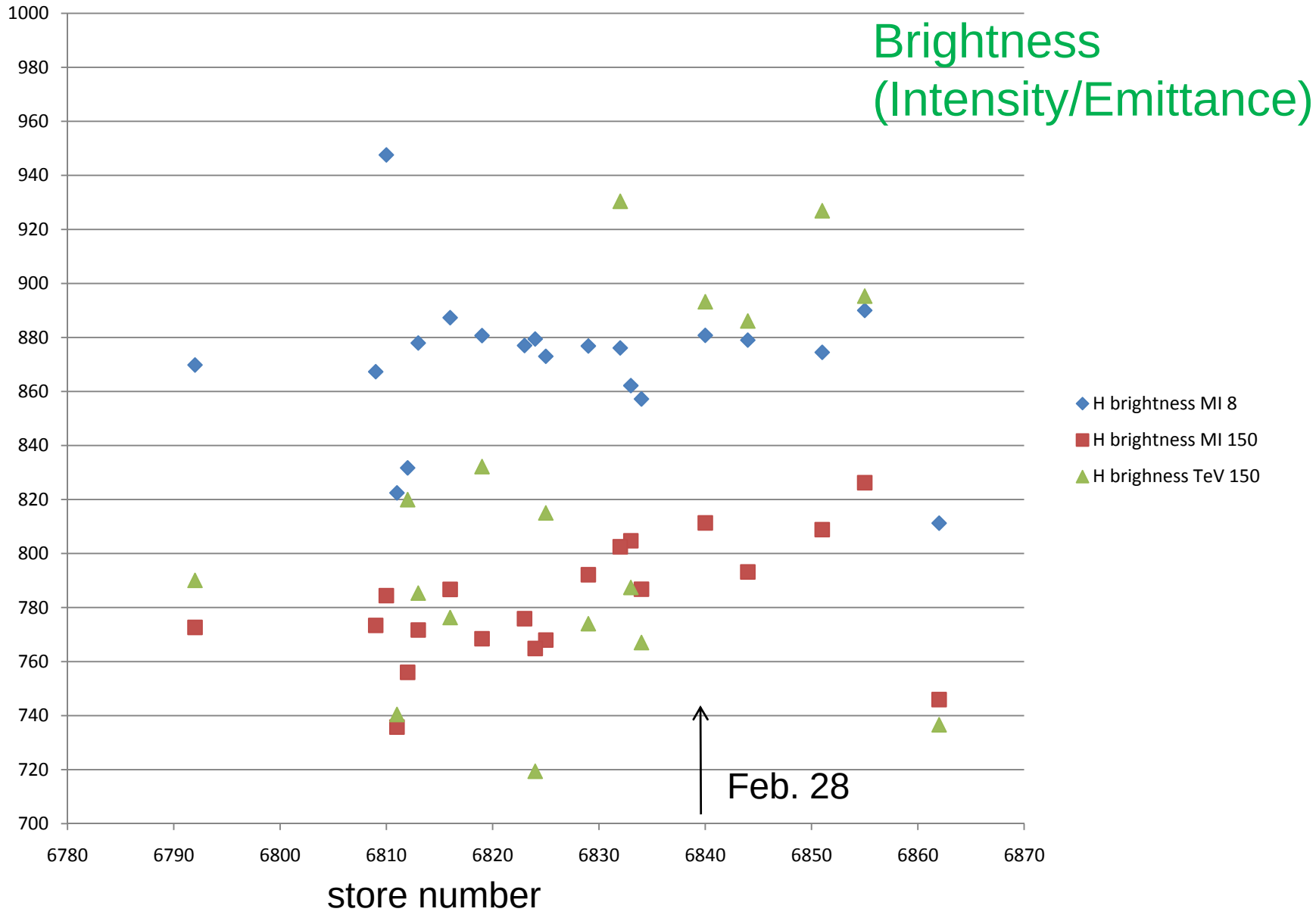
Intensities



Stores 6792-6862 (Feb. 10-Mar. 4, 2009)



Stores 6792-6862 (Feb. 10-Mar. 4, 2009)

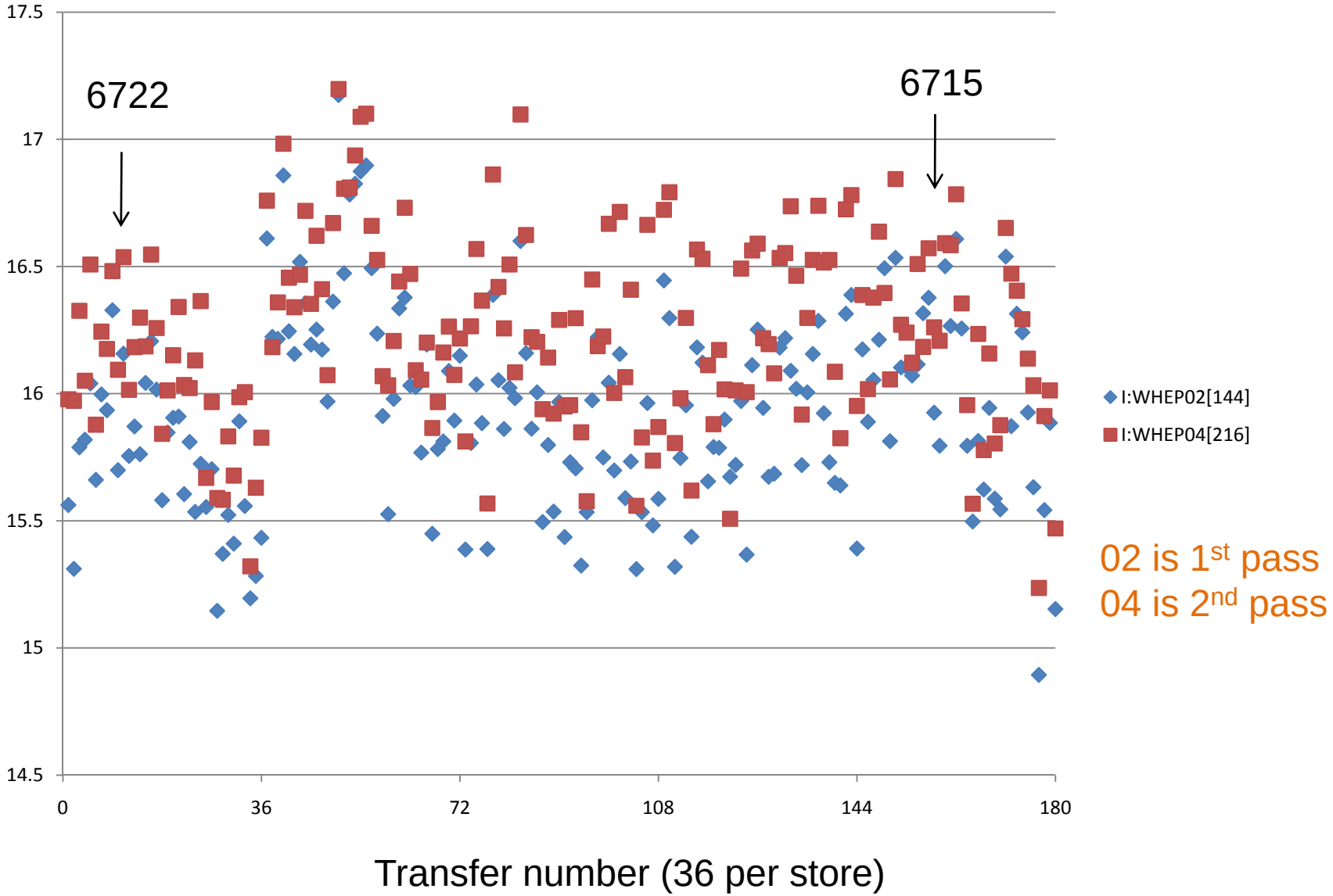


In the next pages we look at horizontal emittances as well as centroids, sigmas, amplitudes and χ's of the Flying Wire profile fits at Main Injector 8 and 150 GeV. In one page we show results for one of these quantities for single batch operation before store 6737, and in the next results for multibatch operation after the MI 8 GeV emittances were fixed (store 6792).

Stores 6715-6722 (Jan. 9-Jan. 12, 2009)

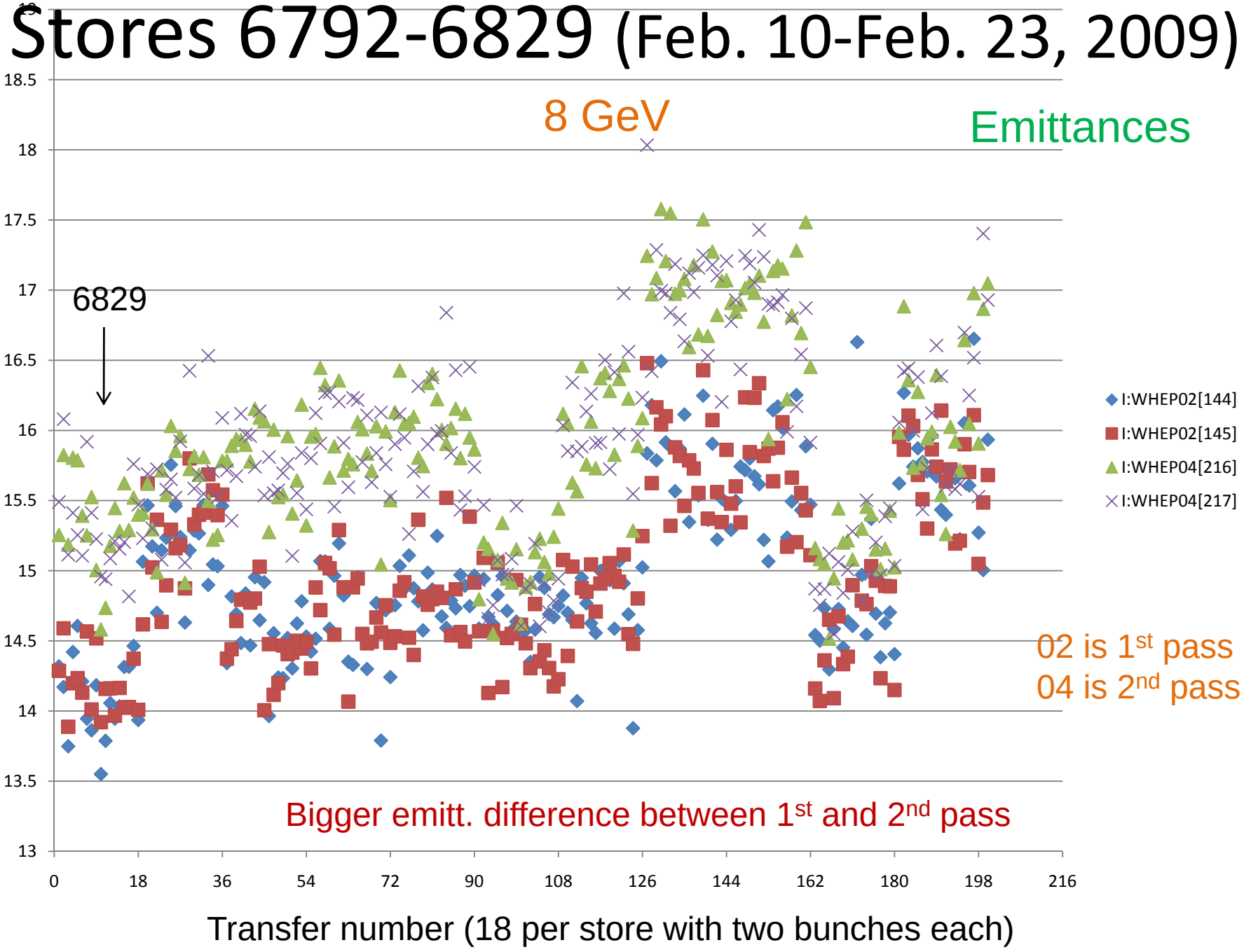
8 GeV

Emittances

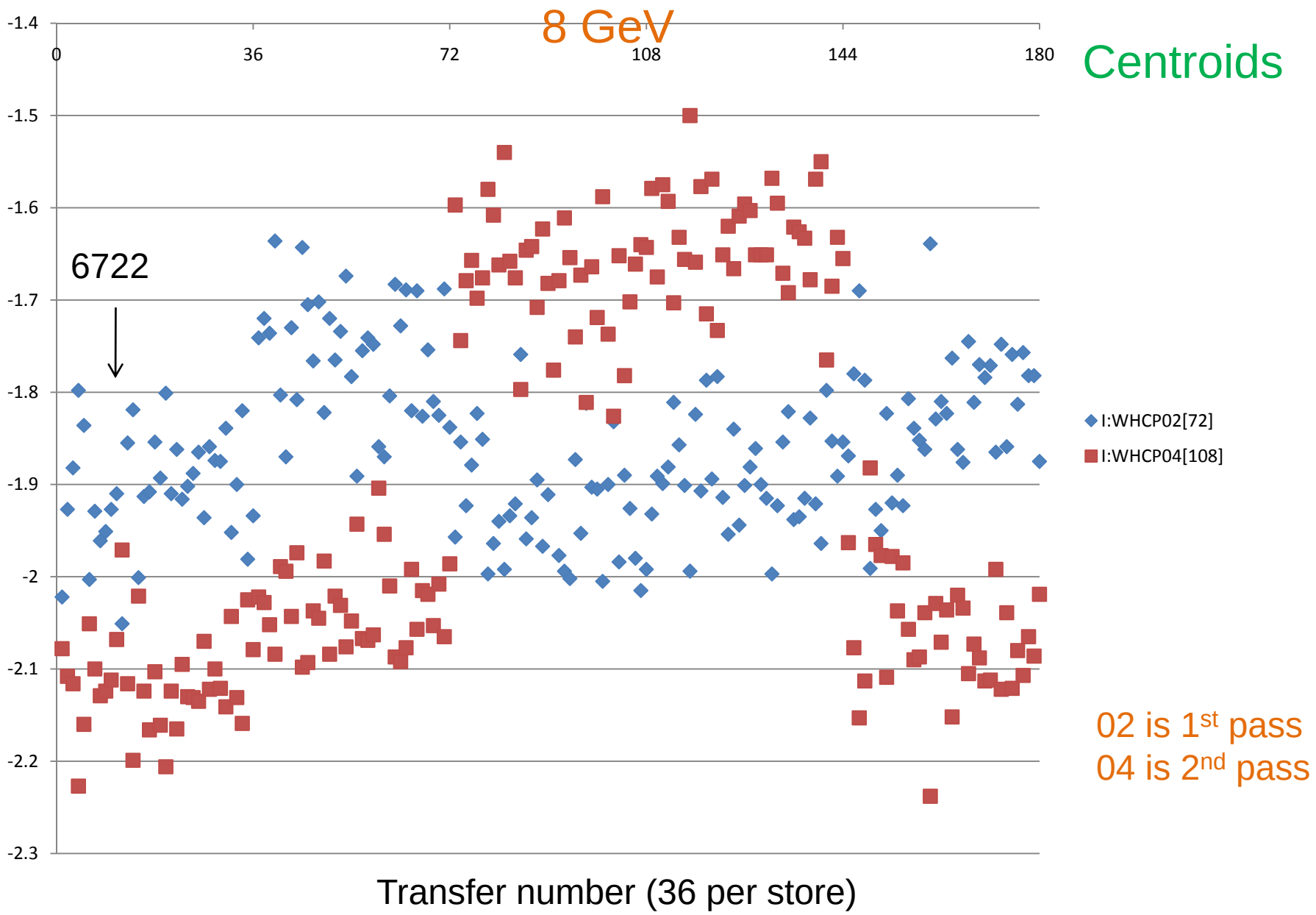


02 is 1st pass
04 is 2nd pass

Stores 6792-6829 (Feb. 10-Feb. 23, 2009)

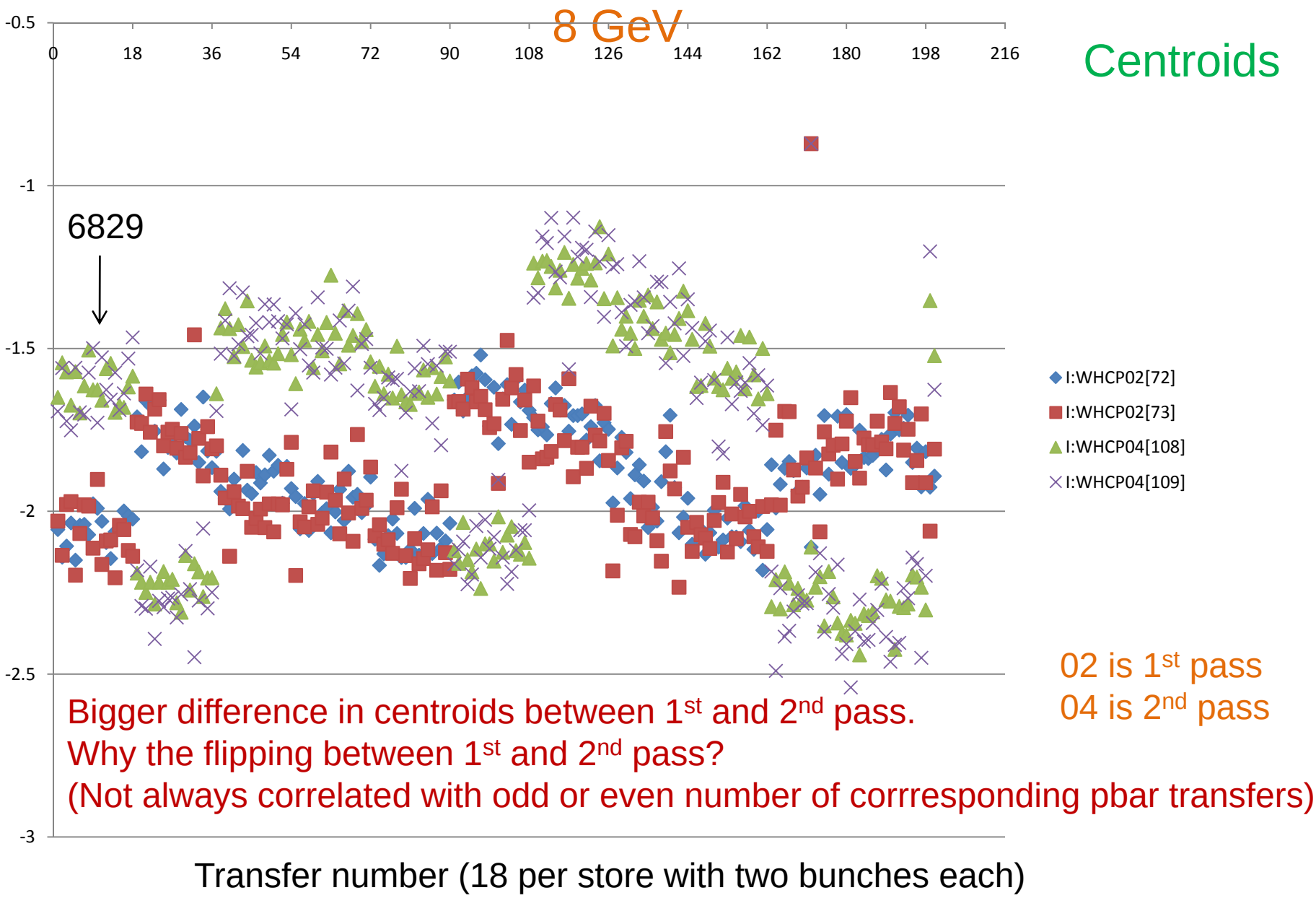


Stores 6715-6722 (Jan. 9-Jan. 12, 2009)

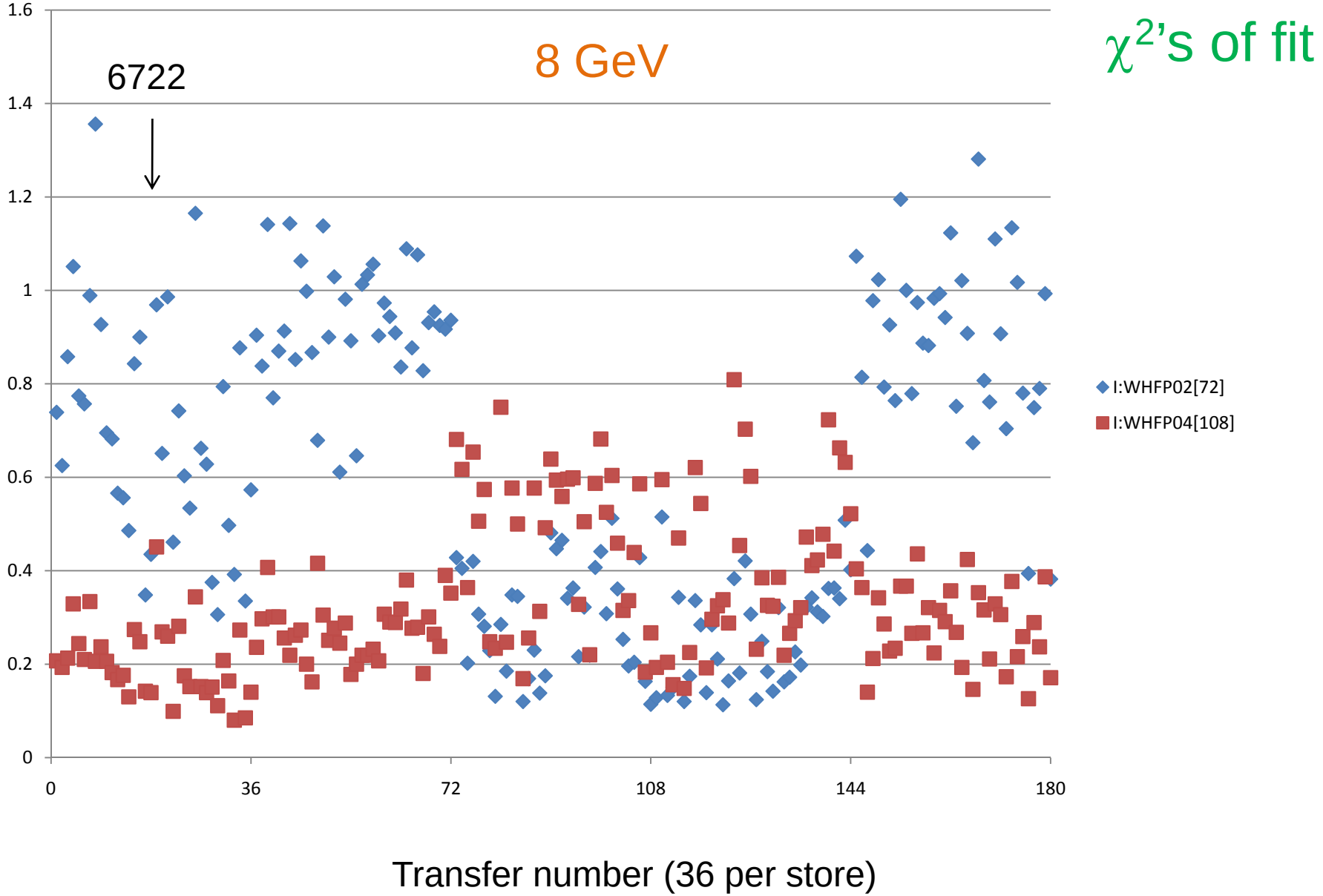


02 is 1st pass
04 is 2nd pass

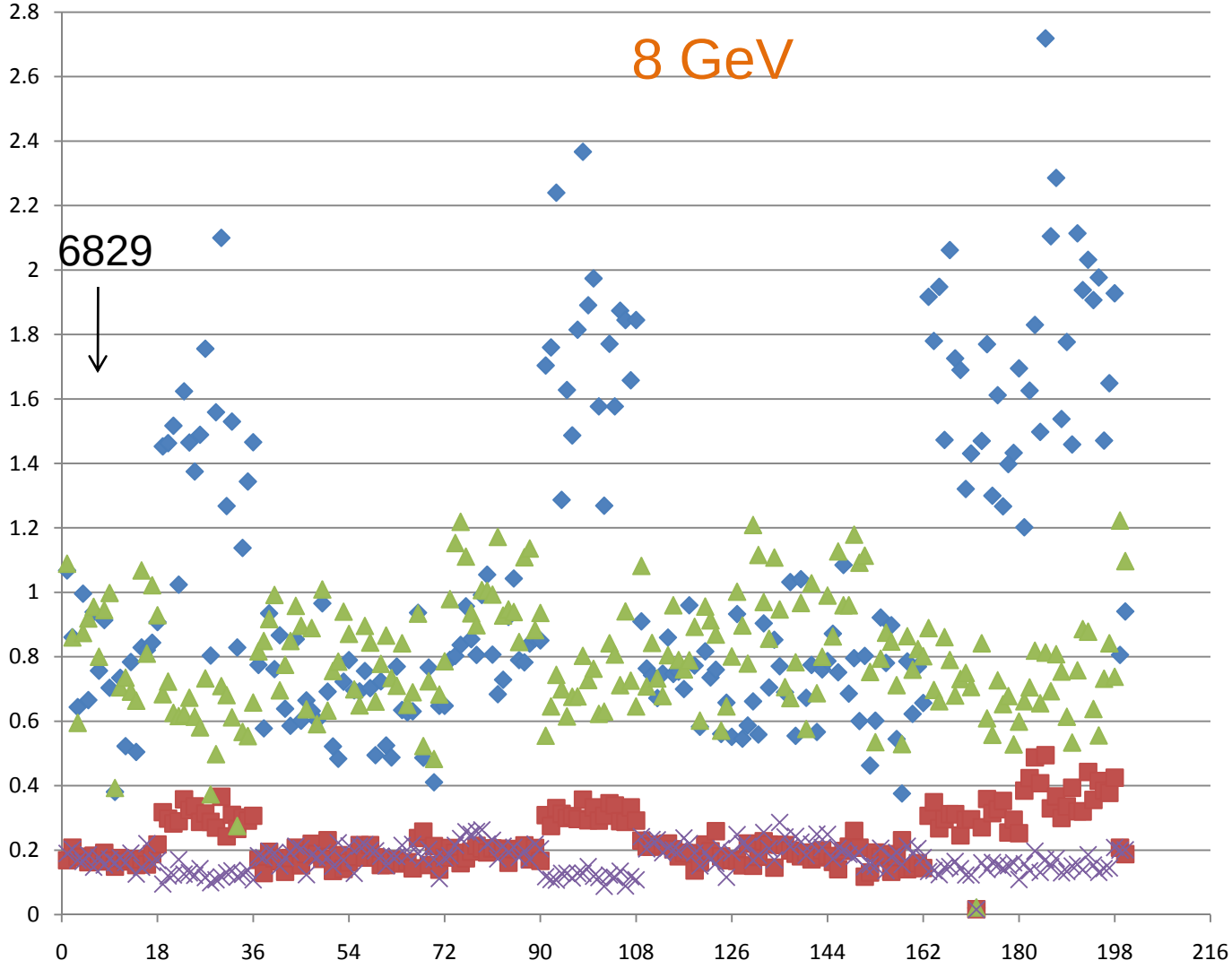
Stores 6792-6829 (Feb. 10-Feb. 23, 2009)



Stores 6715-6722 (Jan. 9-Jan. 12, 2009)



Stores 6792-6829 (Feb. 10-Feb. 23, 2009)

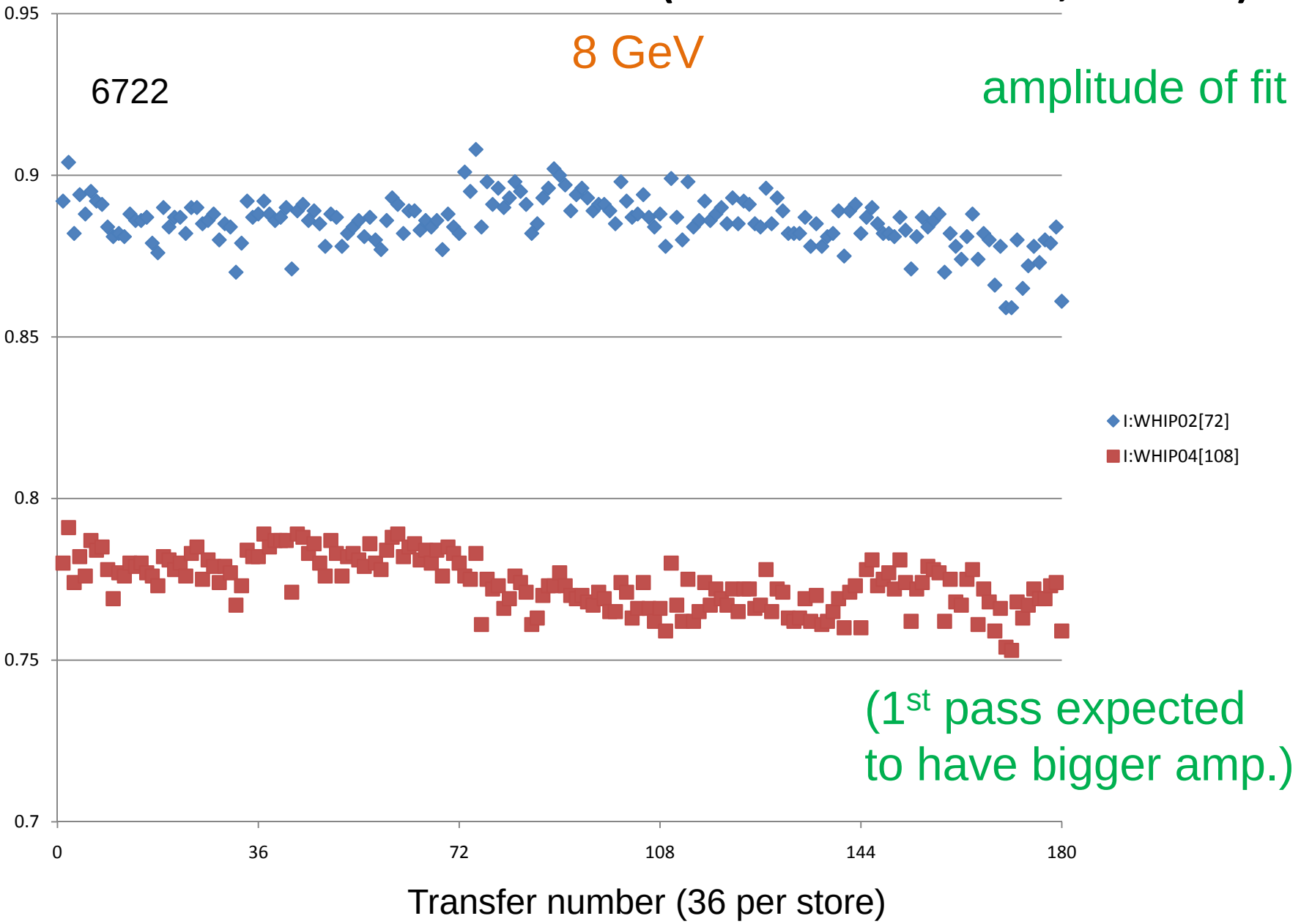


χ^2's of fit

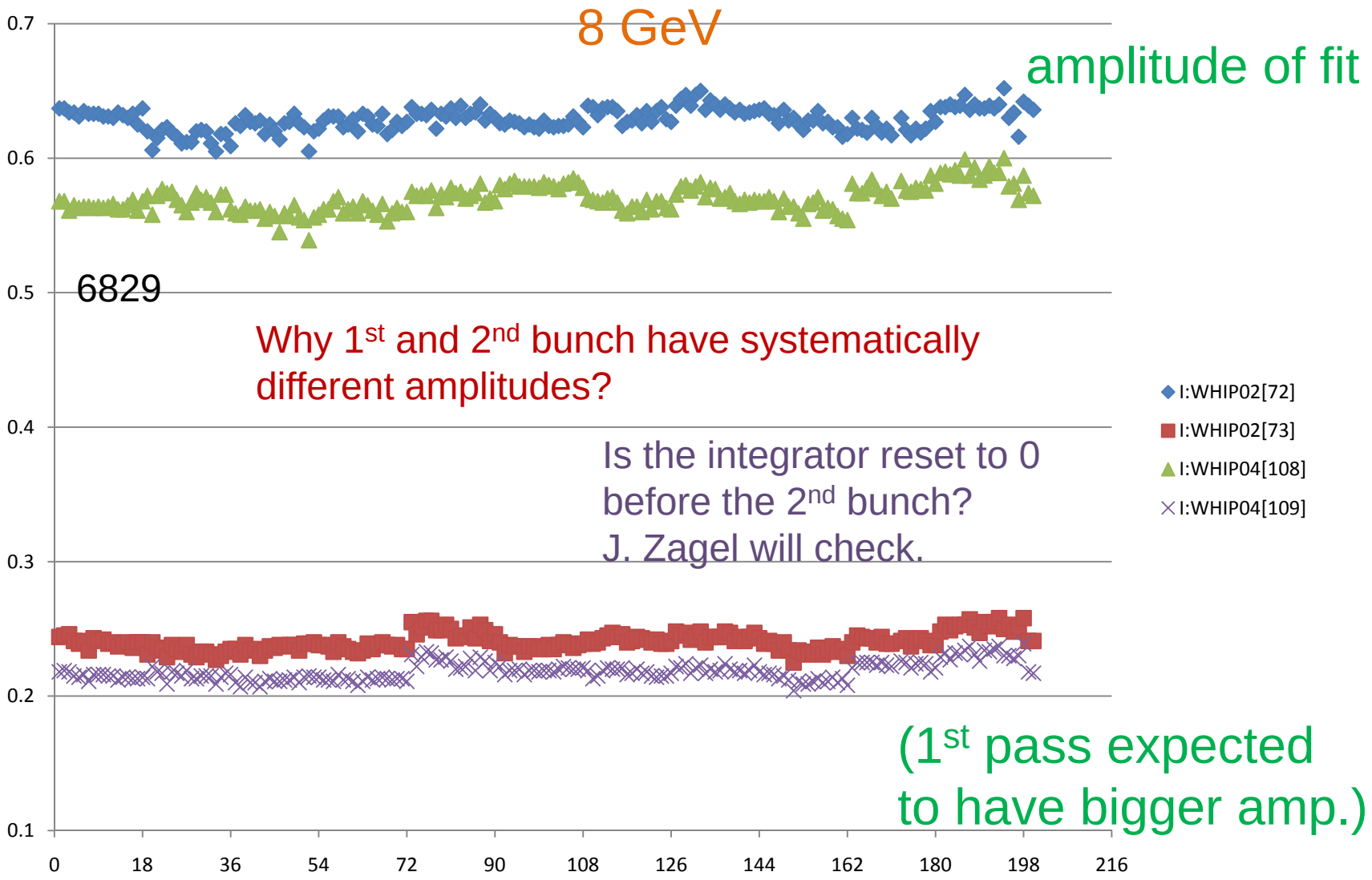
The χ^2's are quite different for the 1st and 2nd bunch/ batch.

Transfer number (18 per store with two bunches each)

Stores 6715-6722 (Jan. 9-Jan. 12, 2009)

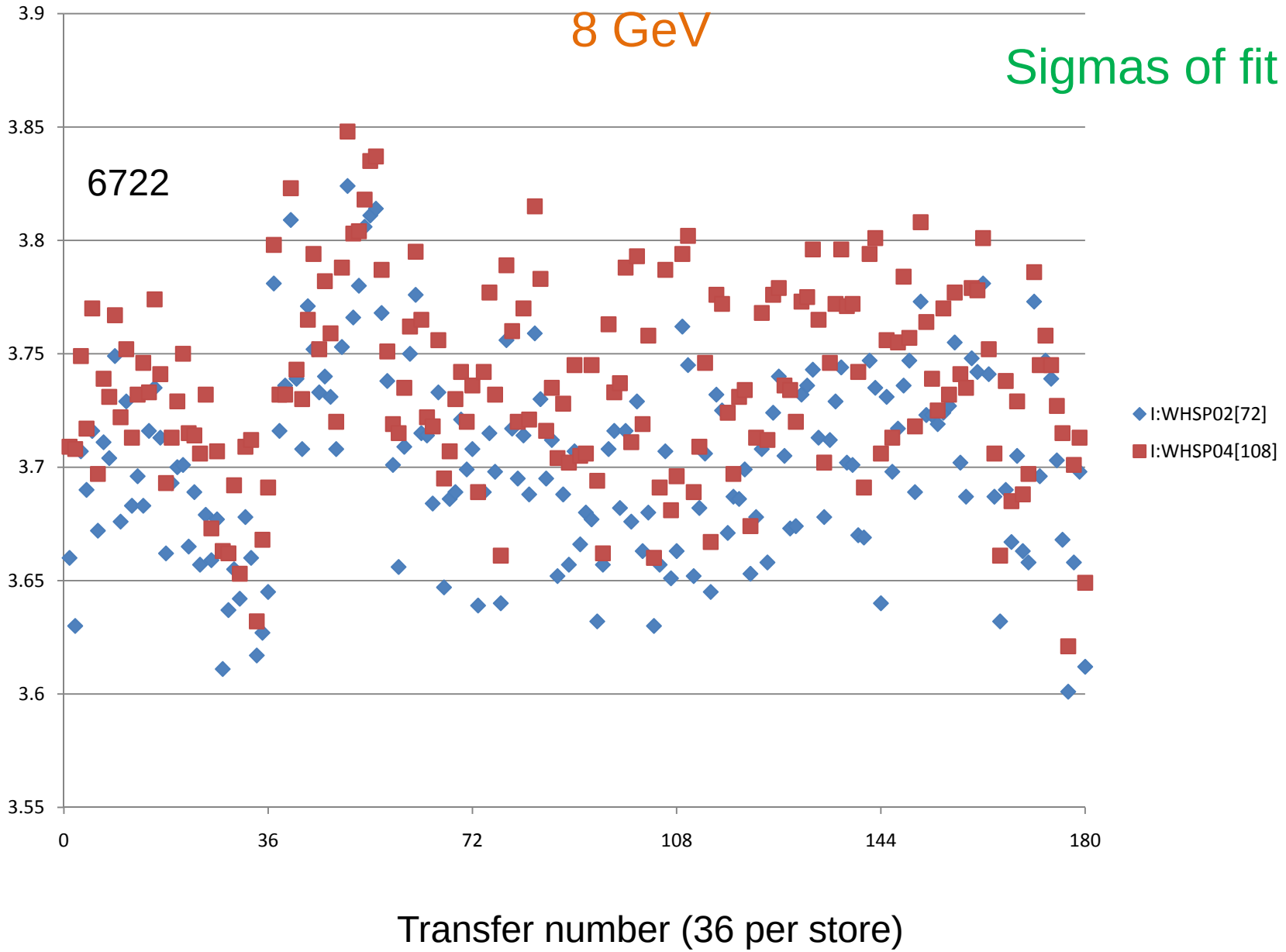


Stores 6792-6829 (Feb. 10-Feb. 23, 2009)

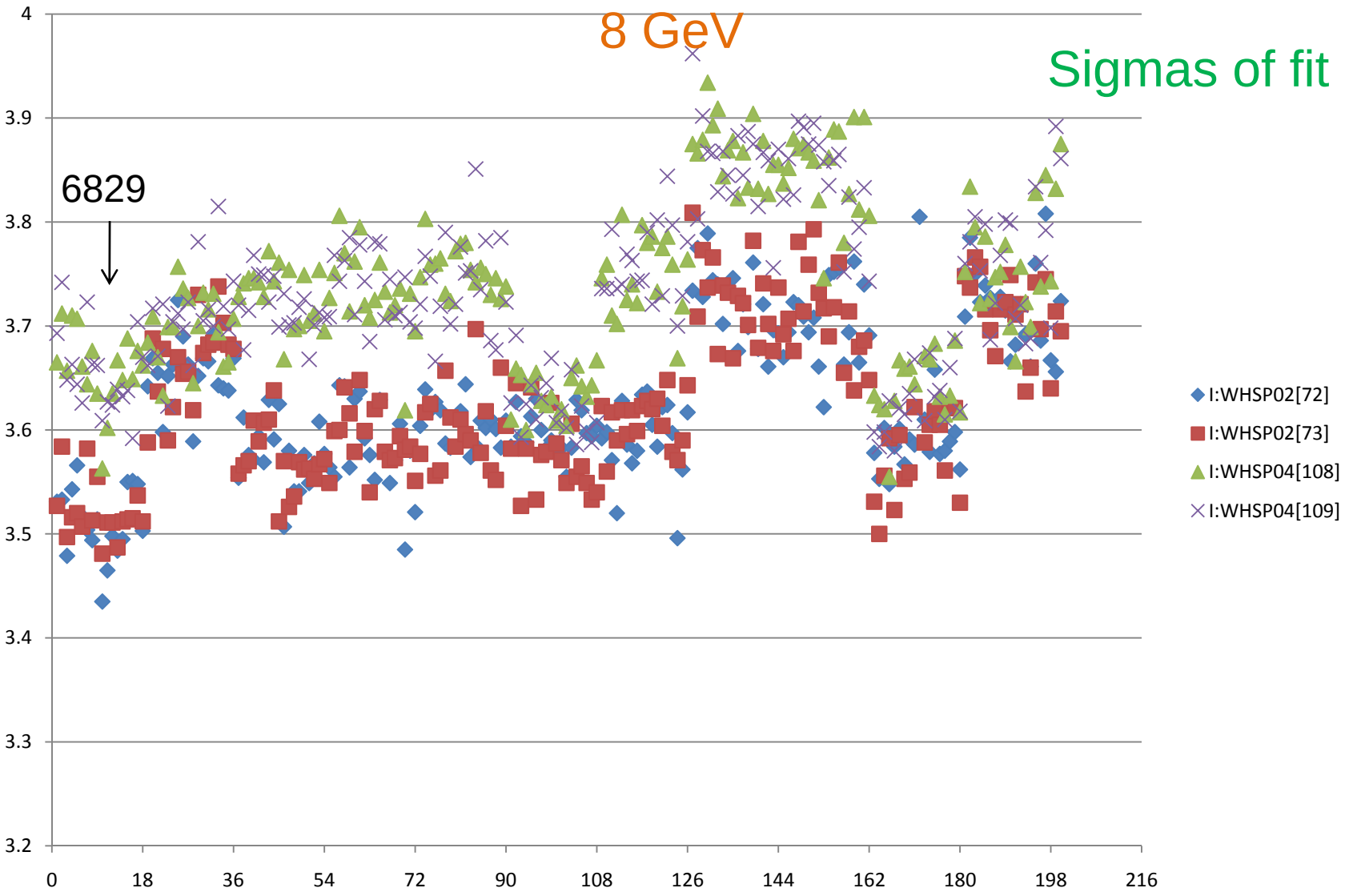


Transfer number (18 per store with two bunches each)

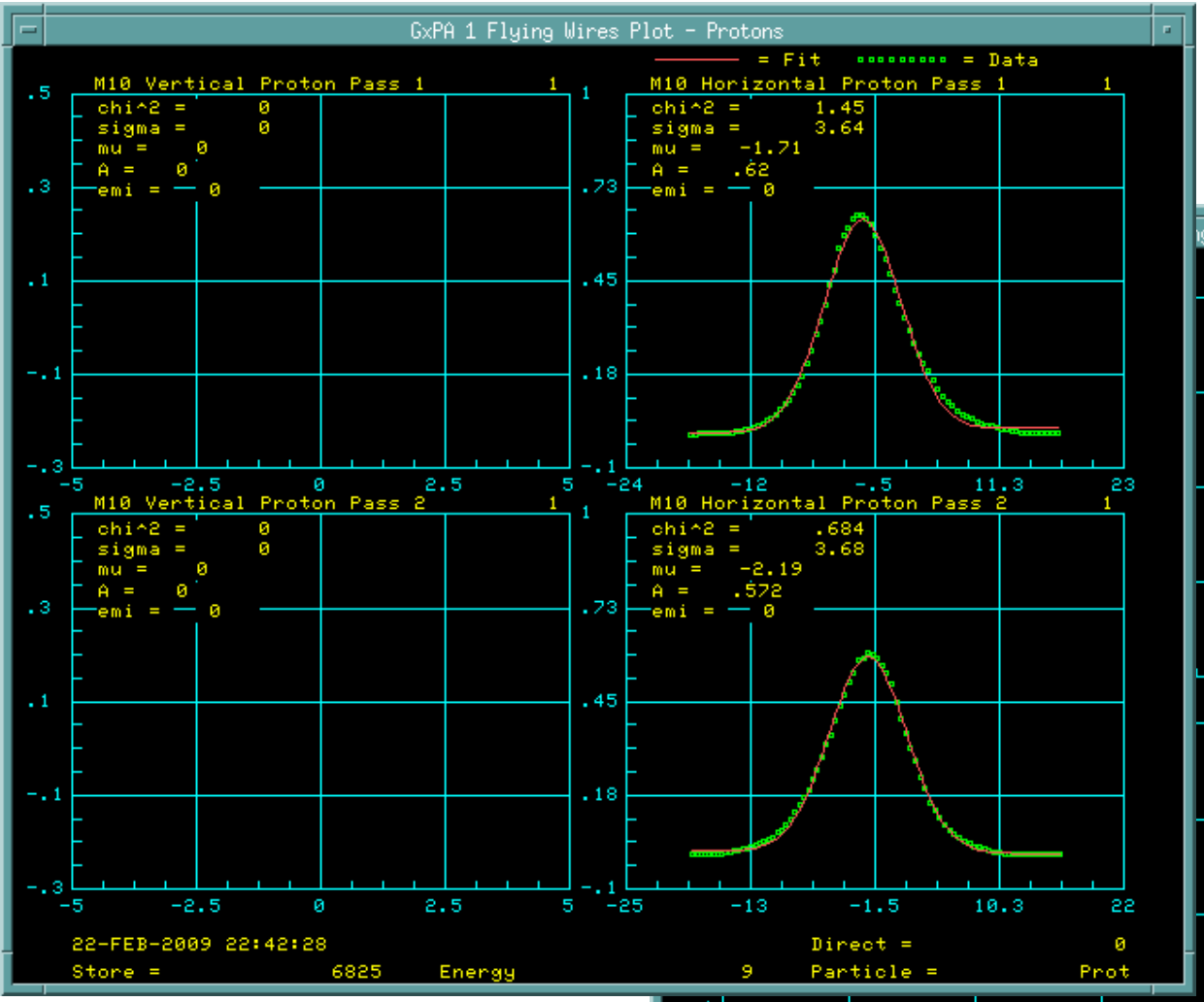
Stores 6715-6722 (Jan. 9-Jan. 12, 2009)

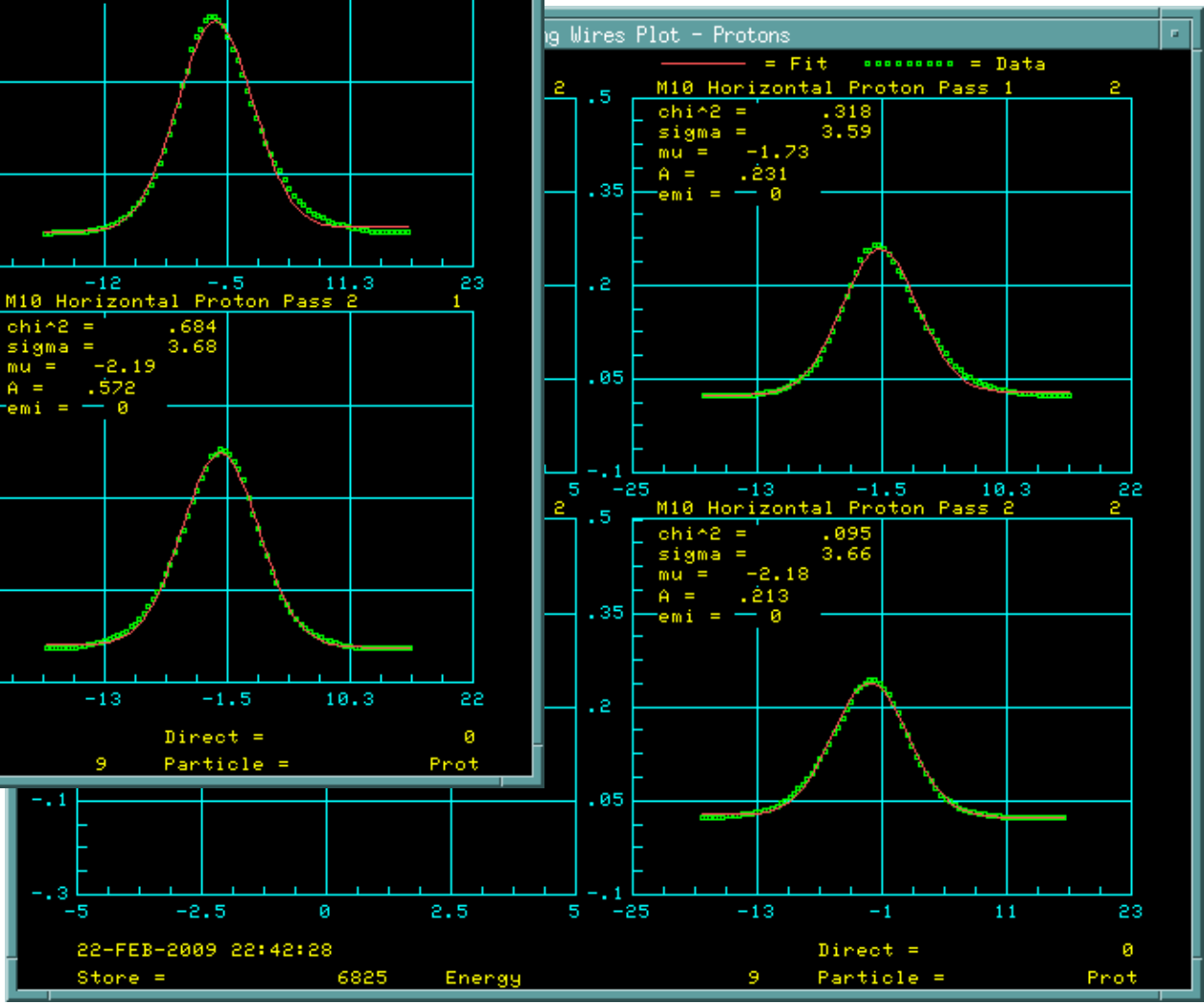


Stores 6792-6829 (Feb. 10-Feb. 23, 2009)

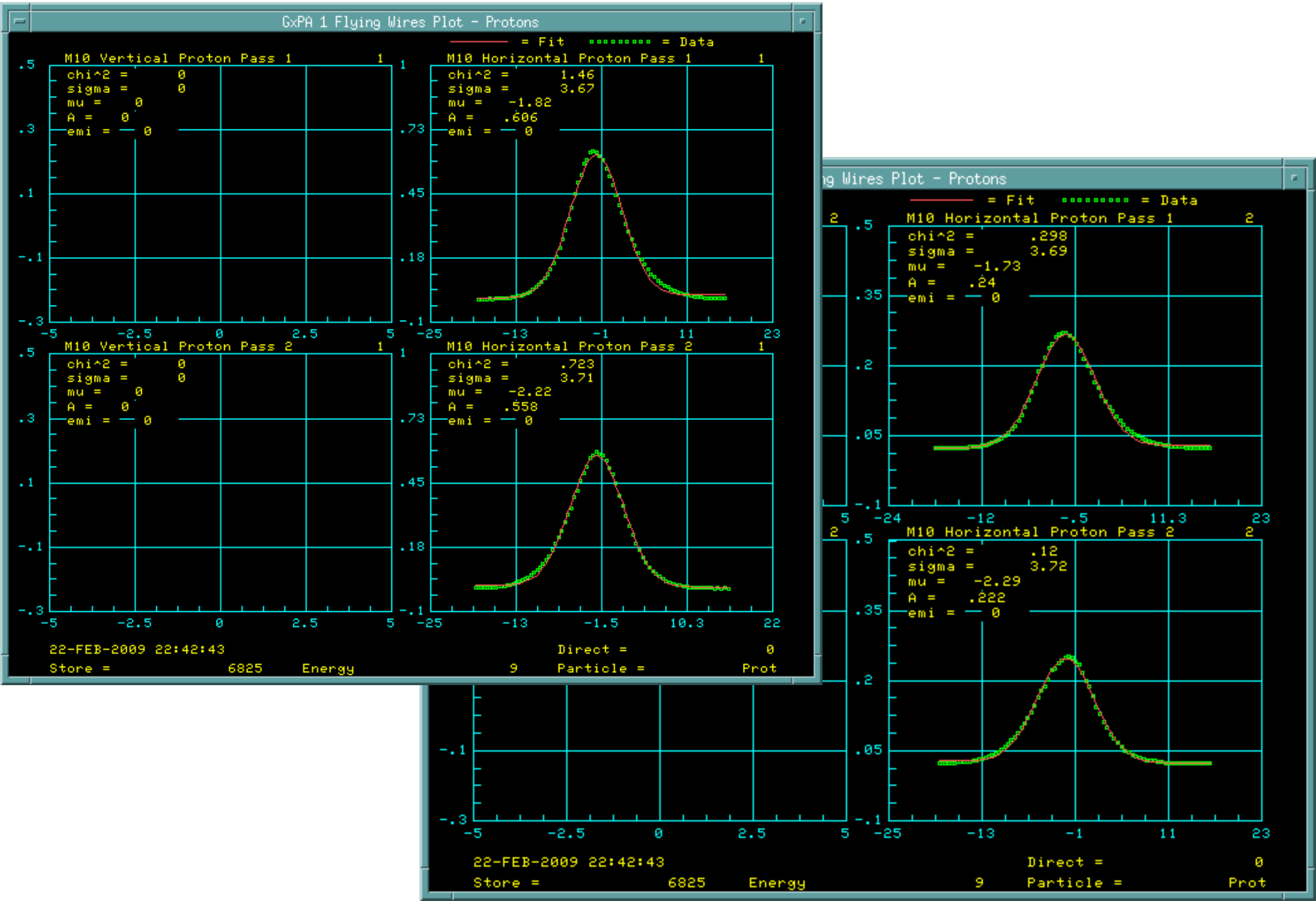


Store 6825, 1st injection

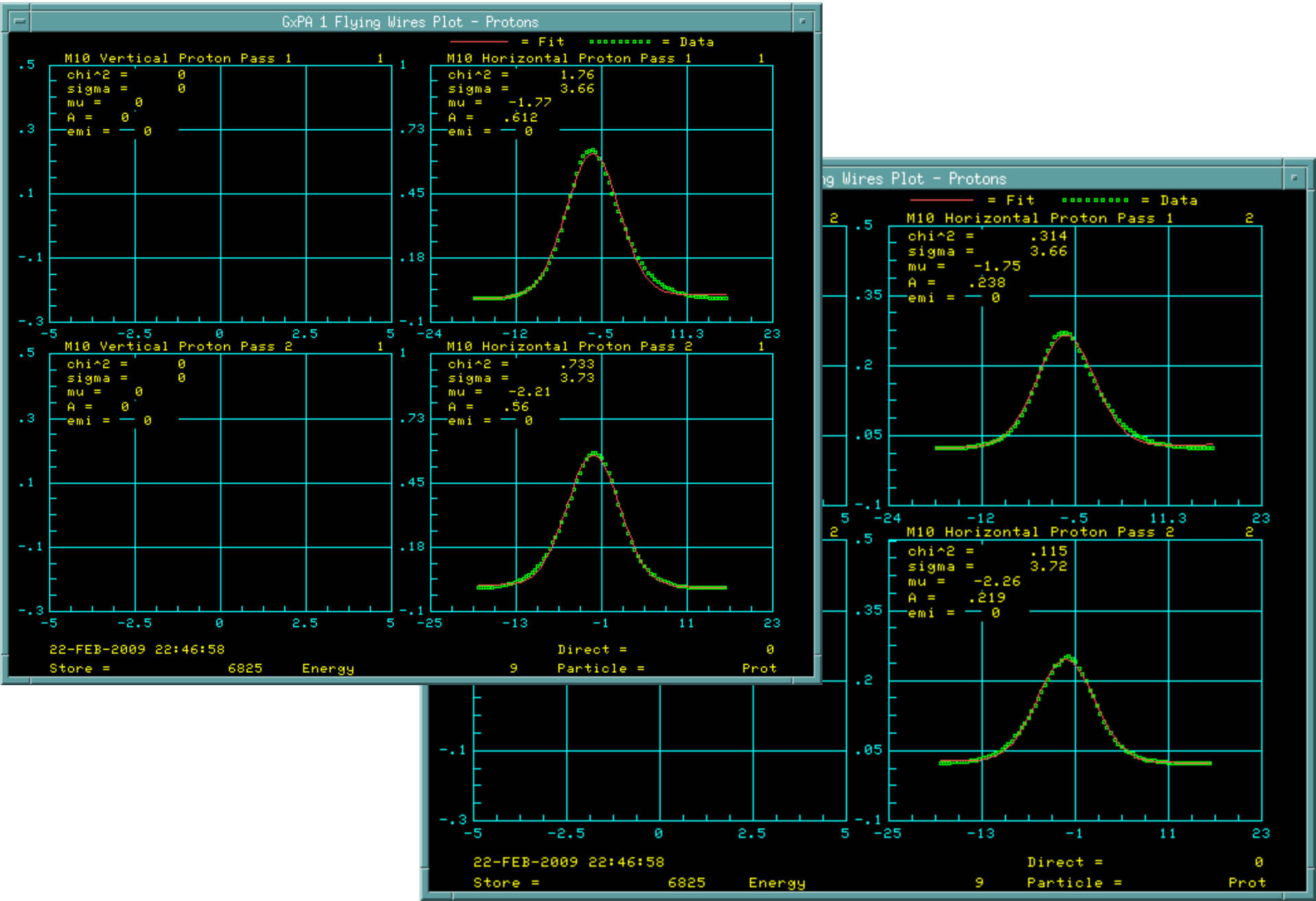




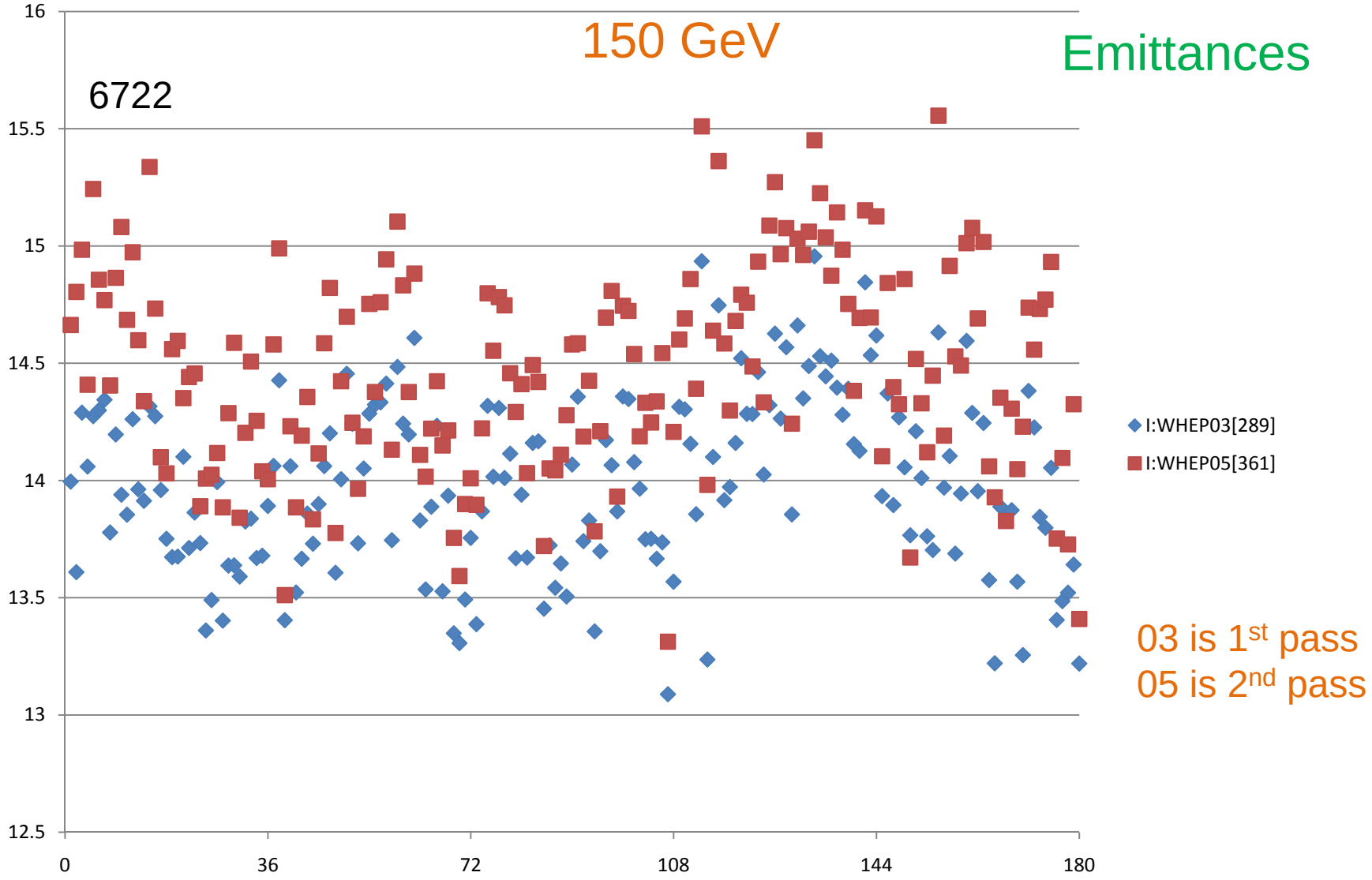
Store 6825, 2nd injection



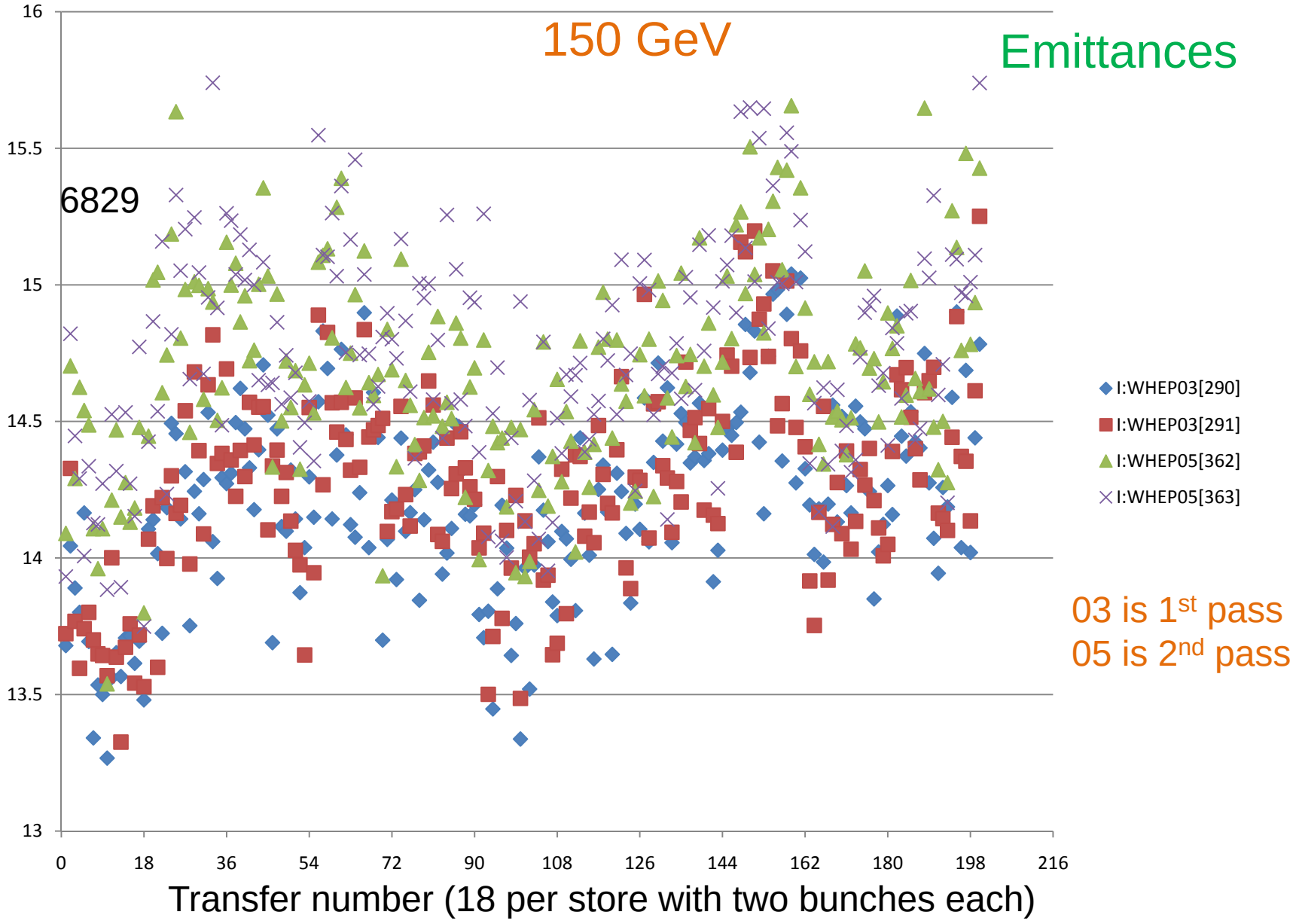
Store 6825, 9th injection



Stores 6715-6722 (Jan. 9-Jan. 12, 2009)



Stores 6792-6829 (Feb. 10-Feb. 23, 2009)



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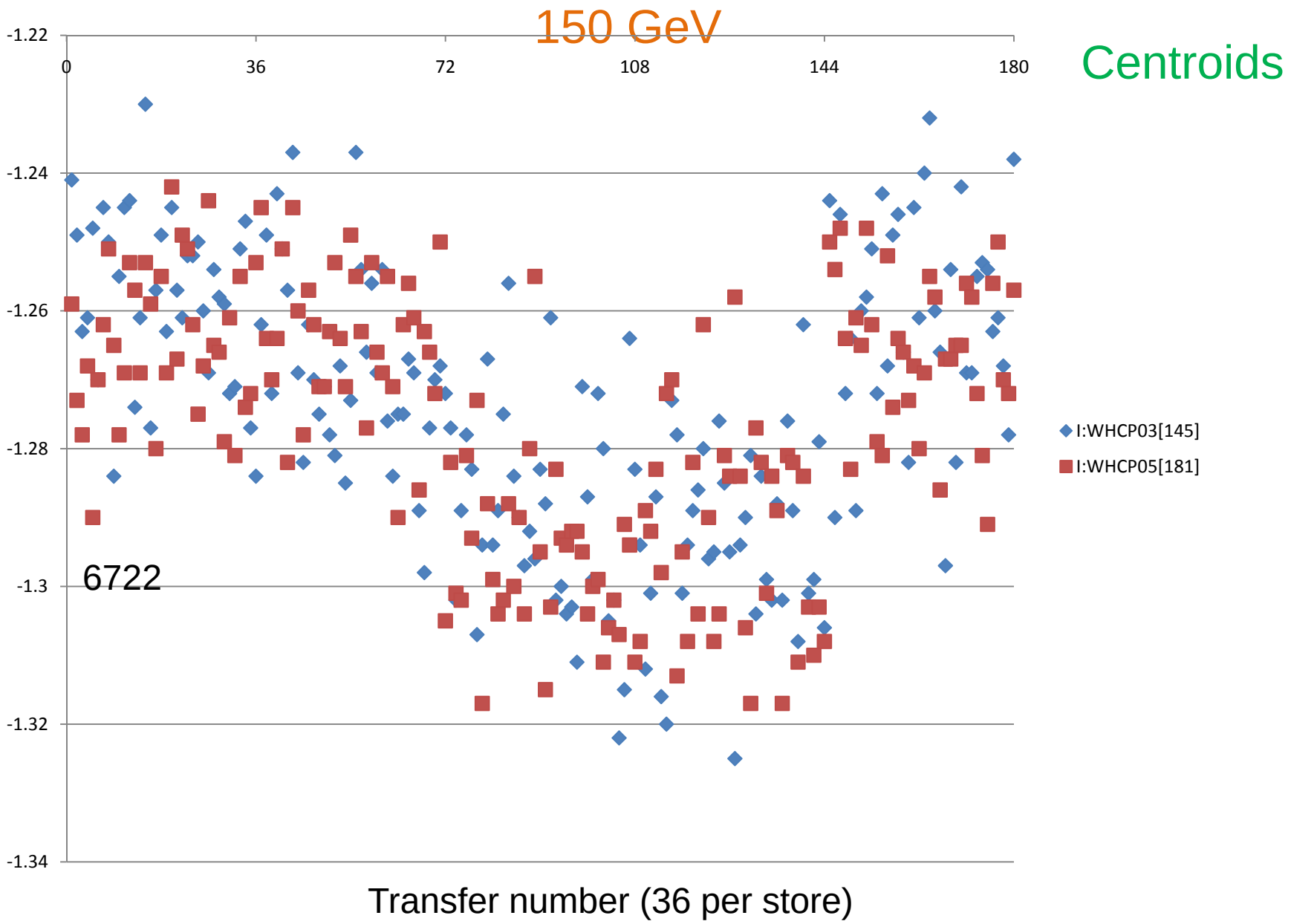

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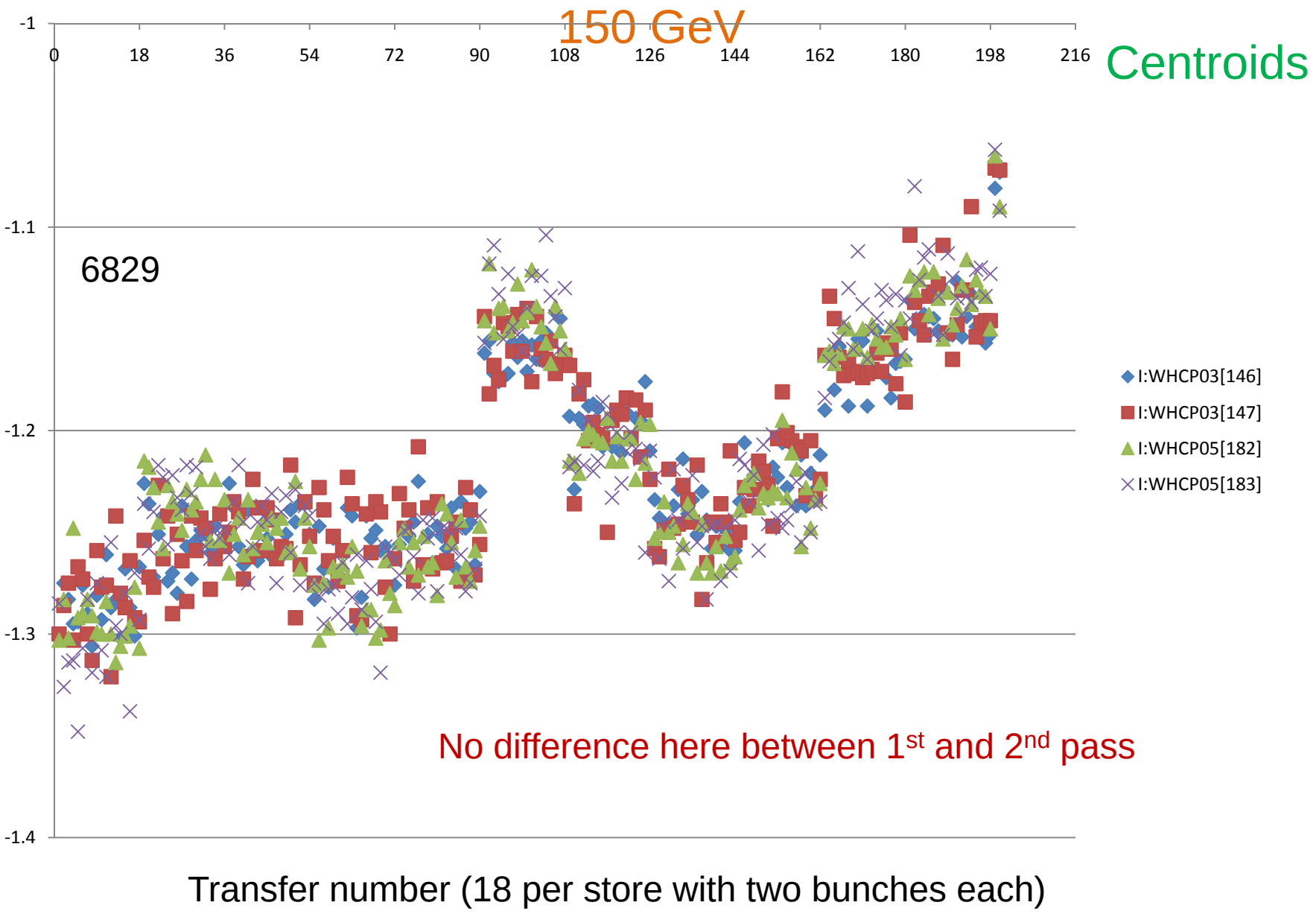

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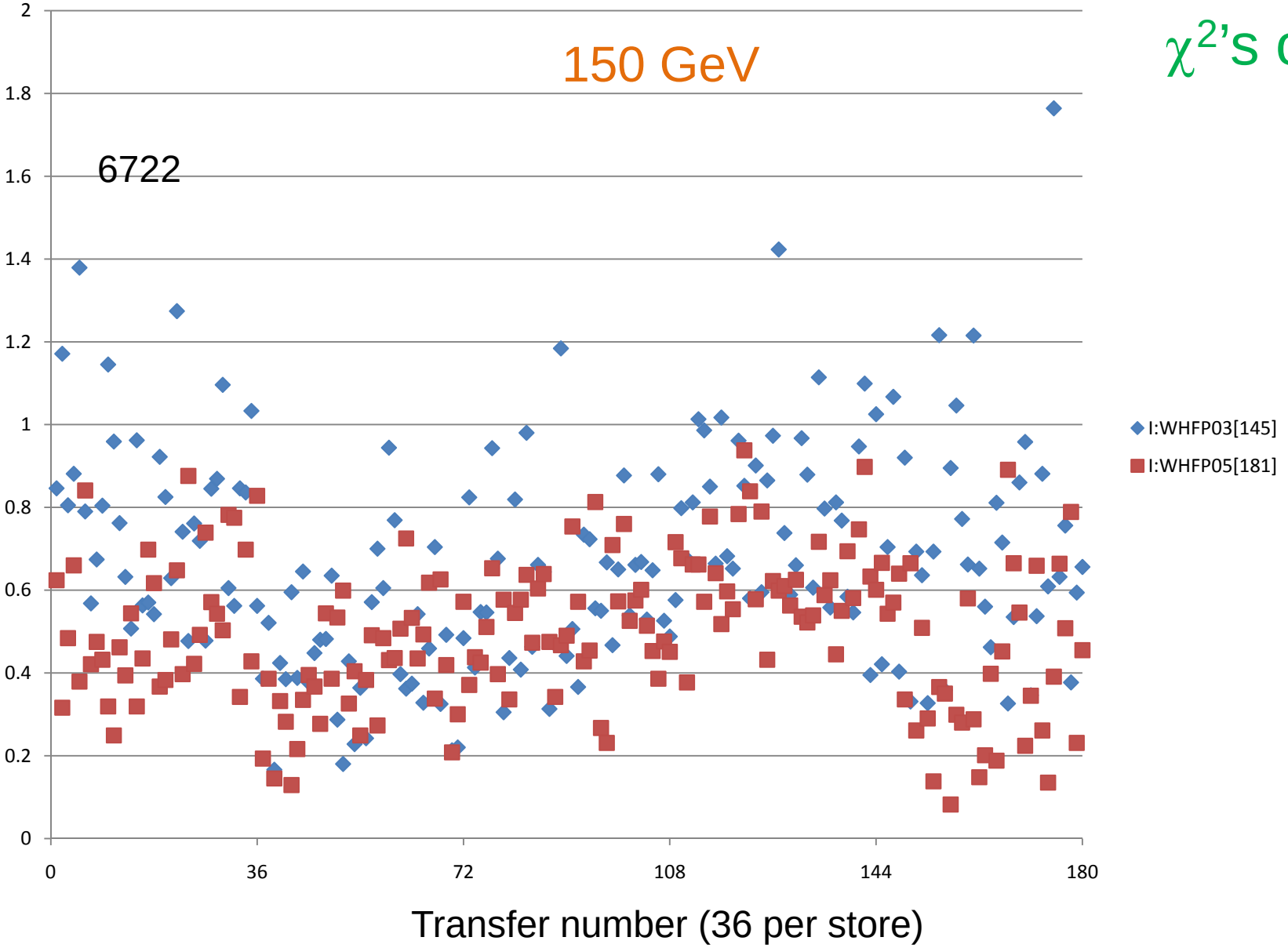
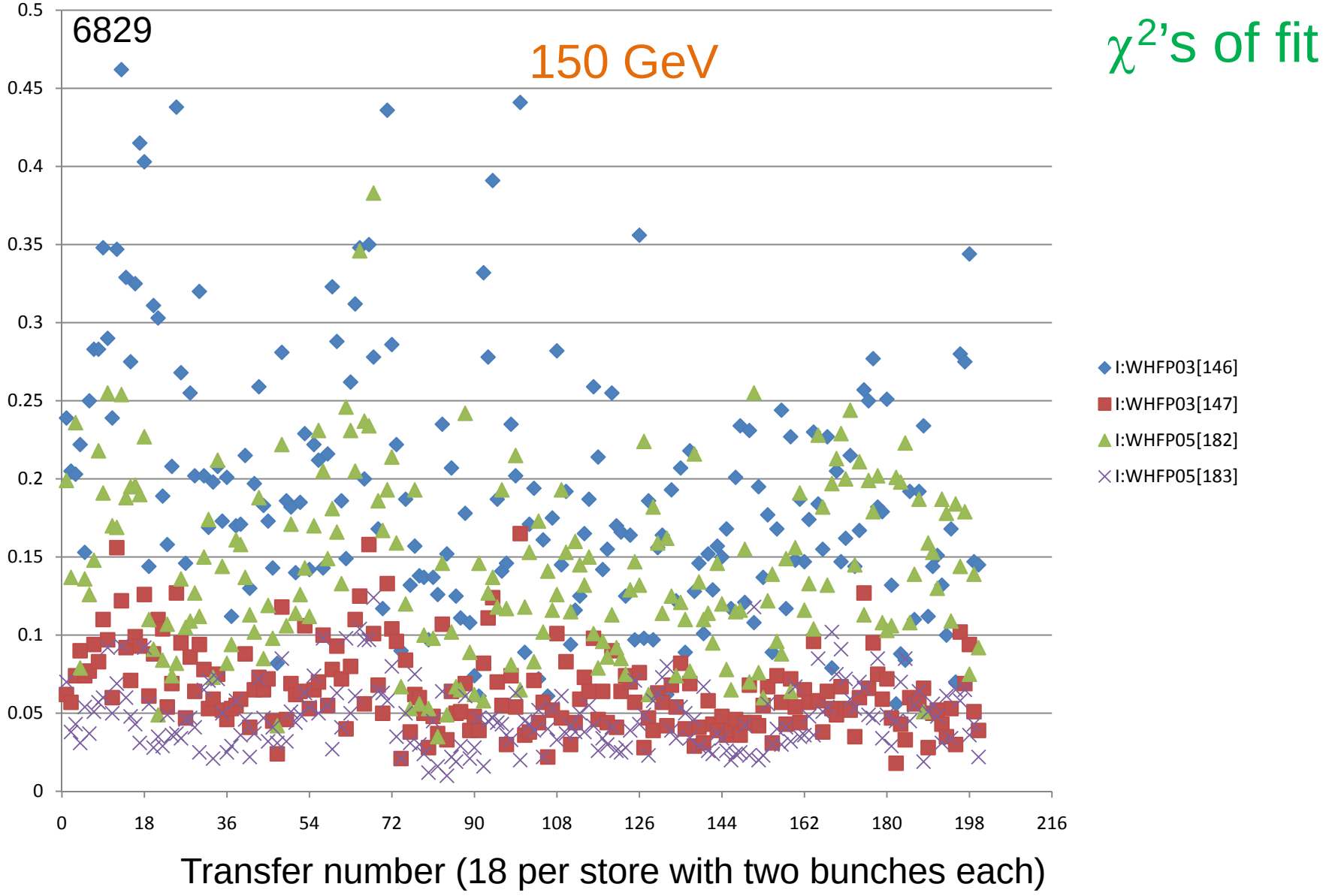
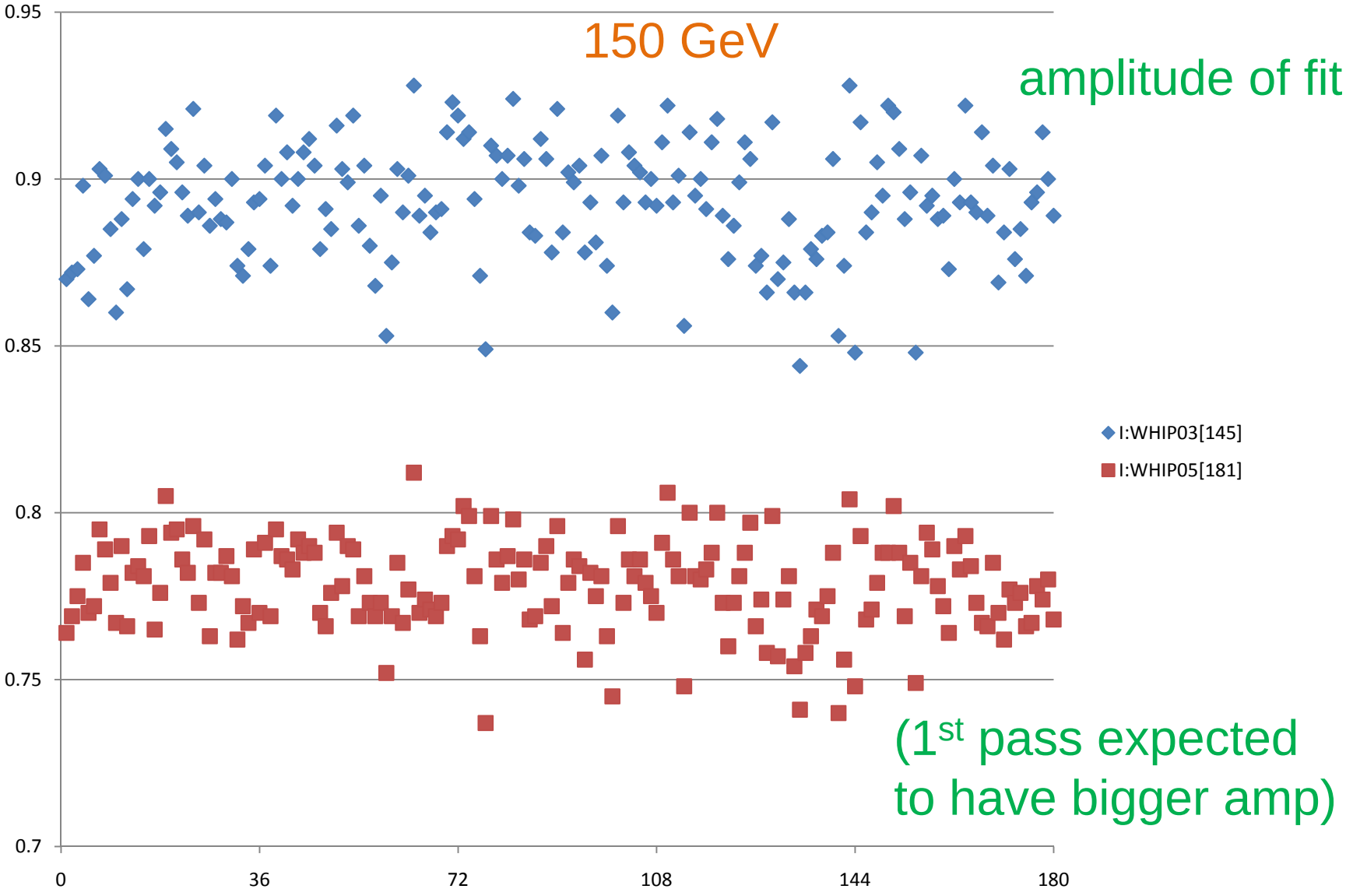


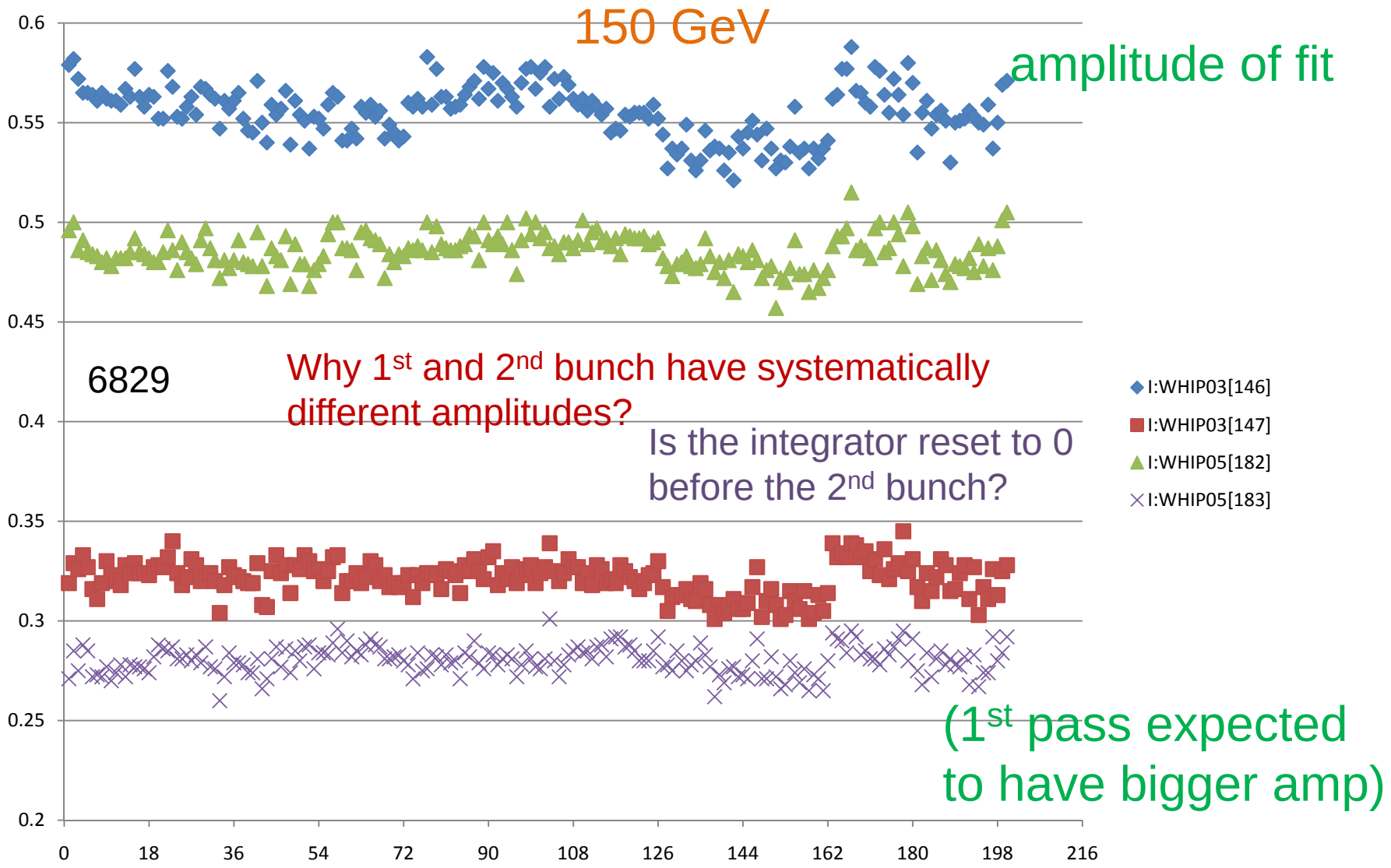
Stores 6792-6829 (Feb. 10-Feb. 23, 2009)



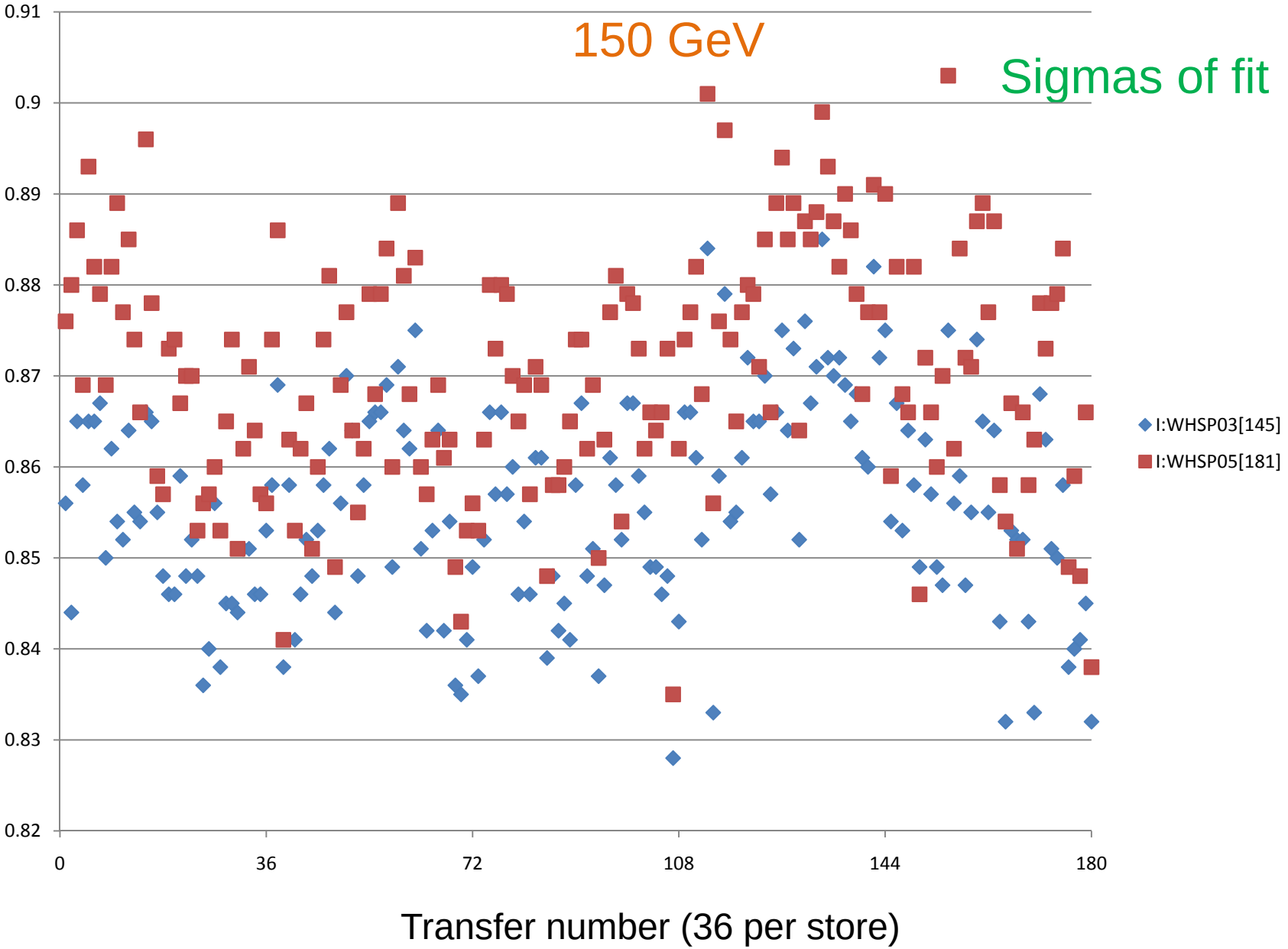
Stores 6715-6722 (Jan. 9-Jan. 12, 2009)



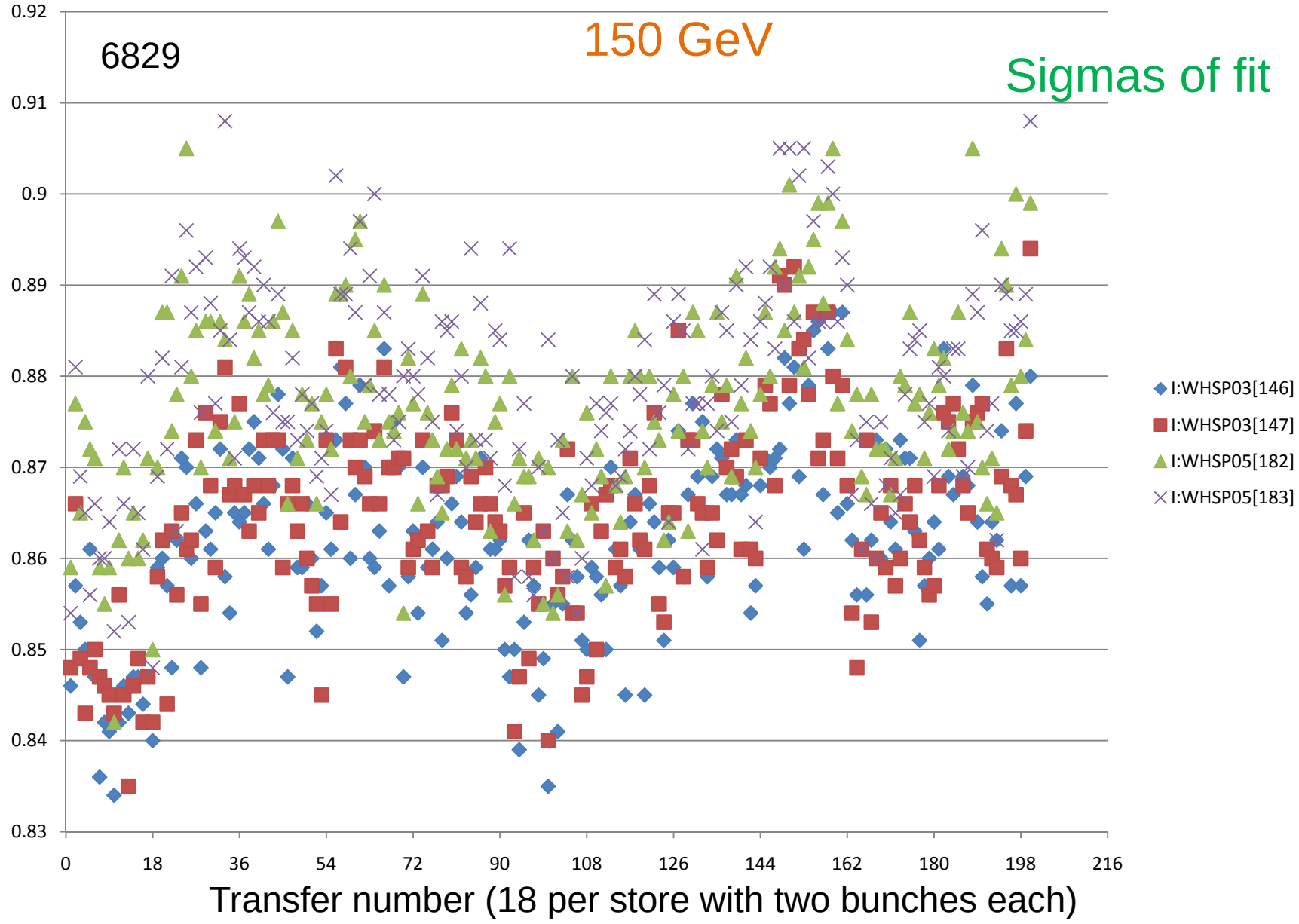
Stores 6792-6829 (Feb. 10-Feb. 23, 2009)



Stores 6715-6722 (Jan. 9-Jan. 12, 2009)



Stores 6792-6829 (Feb. 10-Feb. 23, 2009)



Conclusions

- The MI 8 GeV proton intensities were gradually decreasing in the period Feb. 10 - Feb. 23 but they appear to be constant between Feb. 23 and Mar. 4, 2009. The 8 GeV proton emittances, averages of two batches and two passes, had a decreasing slope in the above time periods but the 8 GeV brightness remained constant.
- The MI 150 and TeV 150 proton emittances started becoming smaller after Feb 23 (except from the very last store) and the corresponding beams became brighter.
- The study revealed several interesting and unexpected features in the emittance measurements, especially during proton multibatch operation.

Conclusions

- For example, the fit amplitudes were significantly different between the 1st and 2nd proton batch at both 8 and 150 GeV and J. Zagel found out that this was due to the fact that the integrator was not resetting to 0 after the 1st batch. An amplitude plot is shown at next page using two stores after the integrator hold time reduction on March 3. There is certainly an improvement after the fix.
- Sigmas, emittances, centroids have been exhibiting bigger differences than before between the 1st and 2nd wire pass at 8 GeV. There have been as well χ^2 differences for the fits of the 1st and 2nd batch.
- We will monitor these features carefully in the stores after the integrator hold time adjustment.

Stores 6856 and 6862 (Mar. 3 and 4, 2009)